

JAN 27 2006

Patent Application  
4241-685(P0443)

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**In re United States Patent Application of:**

**Docket No.: 4241-685**

**Applicant:** XU, Xueping, et al.

**Examiner:** Stein, Stephen J.

**Application No.: 10/712,351**

**Art Unit: 1775**

**Date Filed:** November 13, 2003

**Confirm. No.: 1430**

**Title: LARGE AREA, UNIFORMLY LOW DISLOCATION DENSITY GAN SUBSTRATE AND PROCESS FOR MAKING THE SAME**

**Customer No.:**

23448

**DECLARATION OF ROBERT P. VAUDO UNDER 37 CFR § 1.132 TRAVERSING  
CLAIM REJECTIONS IN UNITED STATES PATENT APPLICATION NO. 10/712,351**

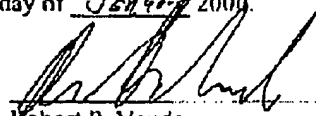
**I, Robert P. Vaudo, hereby declare:**

- (1) THAT I am a co-inventor and applicant for U.S. Patent Application No. 10/712,351, filed on November 13, 2003 in the U.S. Patent and Trademark Office in the names of Xueping Xu and Robert P. Vaudo (hereinafter "Applicants") for "LARGE AREA, UNIFORMLY LOW DISLOCATION DENSITY GaN SUBSTRATE AND PROCESS FOR MAKING THE SAME" (hereinafter "the Application").
- (2) THAT I am currently employed as Senior Research Scientist, GaN Wafers at Cree, Inc., which is a leading innovator and manufacturer of semiconductors, and that prior to my employ at Cree I was employed in a nearly identical capacity at ATMI, Inc., for an aggregate period of over 10 years between these two employers.
- (3) THAT I have gained substantial experience with the development and commercialization of GaN substrate technologies and products, including methods for growing hydride vapor phase epitaxial GaN and testing and quality control procedures for the same, by virtue of my employ at Cree and my former employ at ATMI, Inc.
- (4) THAT based upon my relevant experience, it is exceedingly difficult to grow GaN ingots substantially greater than 10-20 mm long (e.g., thick) without generating a large number

of polycrystalline inclusion defects, with such defects often being caused by transport of undesirable particulates from internal reactor components and being sufficient in size and/or number to substantially interfere with operation of any GaN-based electronic or optoelectronic device constructed from GaN material so grown.

- (5) THAT providing a continuous and reliable supply of source material to a reactor for growing epitaxial GaN at appropriately elevated temperatures and pressures for a period long enough to grow 25 mm long boules is non-trivial.
- (6) THAT I have read U.S. Patent No. 6,468,882 to Motoki et al. (hereinafter "Motoki"), I understand Motoki to suggest a first epitaxial growth of a 2.5 to 3 cm thick GaN ingot over a first period of about 180 hours, followed by slicing of the ingot perpendicular to the growth direction to form multiple seed wafers, followed by a second epitaxial growth of a 2.5 to 3 cm thick GaN ingot on a seed wafer in a direction orthogonal to the first growth over a second period of about 180 hours, to yield a resulting rectangular or cubic ingot having a dimension of approximately 2.5 to 3 cm along each edge.
- (7) THAT based on my experience and my review of Motoki, Motoki does not enable one skilled in the art of growing epitaxial GaN to grow epitaxial, c-axis GaN having a diameter of at least 2 inches (i.e., greater than 5 cm) at a uniformly low defect density of uniformly low dislocation density not exceeding  $3 \times 10^6$  dislocations per square centimeter of growth surface area, since any attempt to grow epitaxial GaN in such a size range using the methods disclosed by Motoki would require at least a 50 mm long (e.g., thick) ingot and would generate a large number of polycrystalline inclusion defects aggregating to a substantial area of unusable material in the resulting product.
- (8) THAT under penalty of perjury I attest that the facts set forth in this declaration are true and correct, that all statements made of my own knowledge are true, and that all statements made on information and belief are believed to be true.
- (9) THAT I have been hereby warned that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of the application or any resulting registration.

Executed at Durham, North Carolina, this 27 day of January 2006.

  
Robert P. Vaudo